# UNITED STATES PATENT AND TRADEMARK OFFICE

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/749,694 | 12/29/2003 | Dimitry Gorinevsky | H0006745 US | 2154 |

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| EXAMINER |
|---|
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| 2624 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

| | Application No. | Applicant(s) |
|---|---|---|
| **Office Action Summary** | 10/749,694 | GORINEVSKY, DIMITRY |
| | Examiner | Art Unit | |
| | Nathan Bloom | 2624 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) ☒ Responsive to communication(s) filed on _29 December 2003_.
2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4) ☒ Claim(s) _1-20_ is/are pending in the application.
   4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) _1-20_ is/are rejected.
7) ☒ Claim(s) _5_ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a) ☐ All   b) ☐ Some * c) ☐ None of:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. _____.
    3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
   Paper No(s)/Mail Date _03/21/2006_.

4) ☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____ .

## DETAILED ACTION

1.      Claim 5 is objected to because of the following informalities:  The claim states "The of

claim 1" wherein it should state "The method of claim 1".  For the purpose of furthering

prosecution this term has been read as what is believed to be the proper correction.  Appropriate

correction is required.

### *Claim Rejections - 35 USC § 112*

1.      The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2.      Claims 3-4, and 11 recite the limitation "said iterative update" in the first line of the

claim.  There is insufficient antecedent basis for this limitation in the claim.

In the interest of furthering the prosecution of the case instant claims 3-4 will be

considered dependent on claim 2 for the remainder of this action.  Furthermore, instant

claims 9 and 11 will be considered dependent on claim 8 for the same reason.

Appropriate corrections are necessary in future amendments/responses.

### *Claim Rejections - 35 USC § 103*

3.      The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4.    Claims 1, 7, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Biemond in further view of Nash ("VLSI Implementation of a Linear Systolic Array").


Instant claim 1:  A method of deblurring an image, comprising the steps of:

downloading a blurred image having pixels into a systolic array processor, said processor

comprising an array of processing logic blocks such that groups of pixel arrive in respective

processing logic blocks [*Biemond discloses an iterative method for image deblurring performed*

*by a computing system.  Biemond describes the method used to process the image but does not*

*explicitly teach the downloading of the image or the use of a systolic array processor.  Examiner*

*takes official notice that the downloading of the image for processing is notoriously well known*

*in the art.  Nash teaches the use of a systolic array for linear processing, and in the $2^{nd}$*

*paragraph on page 1 that the systolic array is broken down into processing elements (processing*

*logic blocks).  It would have been obvious to one of ordinary skill in the art to combine the*

*teaching of Nash and Biemond to increase the processing performance of the system as is*

*disclosed by Nash in the abstract.  Furthermore, deblurring of images is disclosed as an*

*application of the systolic array for on page 3 of Nash under the section entitled "Applications"*

*and as further evidenced by Owens ("Computer Vision of the MGAP") in section 3.1 that the use*

*of systolic algorithms (such as deblurring) for computer vision on an array processor was known*

*to one of ordinary skill in the art.*];

sequentially exchanging data between processing logic blocks by interconnecting each

processing logic block with a predefined number of the processing logic blocks adjacent thereto

[*Nash discloses in the section entitled "Linear Array Organization" the interconnection of the processing elements. Also, further arrangements of processing element interconnections were known as is evidenced by Amin ("PVM Implementations for Low-Level Image Processing Systolic Array Designs")*];

and uploading the deblurred image [*Nash and Biemond do not explicitly teach the uploading of the blurred image. Examiner takes official notice that the uploading of the deblurred (processed) image is notoriously well known in the art. The purpose of deblurring the image is to produce a deblurred image for display or further processing, and thus it would have been obvious to store or upload the processed image for retrieval or display.*].

Instant claims 7 and 14 claim the corresponding device that performs the method of instant claim 1. As per rejection of instant claim 1 the device has been disclosed.

5.      Claims 5, 12, and 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biemond and Nash in view of Owens ("Computer Vision of the MGAP").

Instant claim 5: The method of claim 1, wherein said processor groups pixel in groups that comprise at least one pixel. [*Biemond and Nash teach the deblurring of an image using a systolic processor but do not discuss in detail how to pixels are grouped for processing. However, Owens teaches in the final line of the 2nd paragraph on page 338 that a single pixel is operated on per processor. It would have been obvious to one of ordinary skill in the art to combine Biemond and Nash with Owens because Owens teaches methods of implementing systolic array*

*processors to perform image processing and provides further guidance for processing using the*

*systolic array.*]


Instant claims 12 and 19 claim the corresponding device that performs the method of instant

claim 5. As per the rejection of instant claim 5 the device has been disclosed.


6.      Claims 2, 8, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nash

in view of Biemond ("Iterative Methods for Image Deblurring") and Jagadish ("Array

Architectures for Iterative Algorithms").

Instant claim 2: The method of claim 1, wherein said processing logic blocks providing an

iterative update of said blurred image by (i) providing feedback of the blurred

image prediction error using the deblurred image and (ii) providing feedback of

the past deblurred image estimate [*Nash discloses the systolic array for deblurring  as is*

*disclosed in rejection of instant claim 1, but does not disclose the particular method.  Biemond*

*discloses an iterative method for deblurring images in pages 865-868 under the section titled*

*"C. Iterative Solutions". In particular, see equations 56 and 57 on page 865. Furthermore, as is*

*evidenced by Jagadish in sections 3-5 the implementation of iterative algorithms on a processing*

*array was known to one of ordinary skill in the art.  In particular section 3 discloses the*

*procedure of obtaining the array architectures for iterative algorithms, section 4 shows*

*examples, and section 5 discusses irregular cases. It would have been obvious to one of ordinary*

*skill in the art to combine Nash and Biemond given that it was known in the art to solve image*

*deblurring using iterative methods, and that it was known to one of ordinary skill in the art to*

*use processing arrays for a high performance and low complexity system for deblurring as was*

*known at the time of the invention as was disclosed by Nash in the abstract and the disclosure of*

*deblurring as an application in the "Applications" section.*]

Instant claims 8 and 15 claim the device corresponding to the method of instant claim 2. As per

rejection of instant claim 2 the device has been disclosed.

7.      Claims 3-4, 9-11, and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Nash in view of Biemond, Jagadish, and Gorinevsky ("Optimization-based Tuning of Low-

bandwidth Control in Spatially Distributed Systems").

Instant claim 3:  The method of claim **2**, wherein said iterative update is implemented in said

processing logic blocks by $u(n+1) \equiv u(n) - K * \left( H * u(n) - y_b \right) - S * u(n)$  [*Biemond: see*

*equations 56 and 57 on page 865, u(n+1)=f(k+1), u(n)=f(k), g=$y_b$, K=B, and H=H* ] where u is

the ideal undistorted image, m and n are column and row indices of an image pixel element,

$y_b(m,n)$ is the observed blurred image, * denotes a 2-D convolution, K is a feedback update

operator with a convolution kernel k(m,n) and S is a smoothing operator with a convolution

kernel s(m,n) [*Biemond identifies the existence of regularization error and discloses a solution of*

*the regularization error in section 5 which begins on page 868. The term $S * u(n)$ was known to*

*one of ordinary skill in the art as a solution to the regularization problem as is disclosed by*

*Gorinevsky in sections 1 and 3 as a filter that improves the spatial response (reduces*

*regularization error) of the system. It would have been obvious to one of ordinary skill in the art*

*to combine Gorinevsky and Biemond to improve the spatial response (reduce regularization*

*error) of the deblurring method. Furthermore, in the same sections of Gorinevsky the use of the*

*term K has been disclosed.*].

The method of instant claim 4 is a modification of the method of instant claim 3 wherein the

deblurring is performed on each color space separately. The method of dividing an image into

its color spaces and then deblurring (further processing) each color space was known to one of

ordinary skill in the art as is evidenced by Dowski (US 2003/0169944) in paragraph 0018.

Instant claims 9 and 16 claim the device corresponding to the method of instant claim 3. As per

rejection of instant claim 3 the device has been disclosed.

Instant claims 10 and 17: The device of claim 9 [*and 16*], wherein the operators H, K, and S are

preloaded in each of the array processing logic blocks. [*Nash, Jagadish, and Gorinevsky do not*

*explicitly teach the preloading of the information into each processing logic block. However,*

*Examiner takes official notices that it is notoriously known that in order to perform*

*mathematical computations with these operators that the these factors would have to have been*

*initialized prior to performing the computations.*]

Instant claims 11 and 18 claim the device corresponding to the method of claim 4. As per the

rejection of instant claim 4 the device has been disclosed.

8.　　　Claims 6, 13, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nash

in further view of Owens ("Computer Vision on the MGAP").

Instant claim 6:　The method of claim 5, wherein said groups of pixels comprises a group

selected from 2 by 2 pixels, 3 by 3 pixels, and 4 by 4 pixels. [*Filtering and image processing*

*methods such as deblurring are done locally by particular filter sizes depending on the desired*

*outcome.　Owens describes image processing using array processors is section 3.1 on page 338*

*disclosed the use of 3x3 masks applied to the image and hence it was known to group and*

*process pixels in the 3x3 format in a processing array.　It would have been obvious to one of*

*ordinary skill in the art to combine Nash and Owens to improve the utility and efficiency of the*

*processing arrays by allowing local filtering operations to be performed on groups of pixels.*]

Instant claims 13 and 20 claim the device corresponding to the method of instant claim 6.　As per

the rejection of instant claim 6 the device has been disclosed.

### *Conclusion*

9.　　　The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure.

- Dowski et al (US 2003/0169944) – color component processing
- Amin ("PVM Implementations for Low-Level Image Processing Systolic Array

   Designs") – array processing hardware and design for image processing

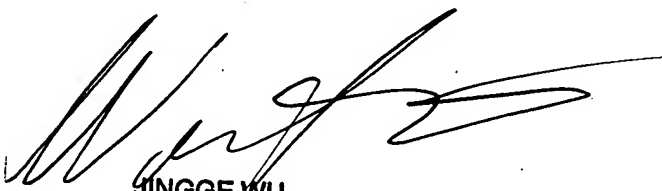- Richard Hughey, (Programming Systolic Arrays) – relevant to implementation of methods

### *Contact Information*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu, can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Bloom

JINGGE WU
SUPERVISORY PATENT EXAMINER